
CONTENTS

1.0 INTRODUCTION.....	1-1
1.1 Purpose of Report	1-1
1.2 Lands Involved and Record Data	1-2
2.0 DESCRIPTION OF GEOLOGY	2-1
2.1 Physiography.....	2-1
2.2 Stratigraphy	2-3
2.2.1 Precambrian Era.....	2-3
2.2.2 Paleozoic Era	2-3
2.2.2.1 Cambrian System.....	2-3
2.2.2.2 Ordovician, Silurian, and Devonian Systems	2-5
2.2.2.3 Mississippian System.....	2-5
2.2.2.4 Pennsylvanian System.....	2-5
2.2.2.5 Permian System.....	2-6
2.2.3 Mesozoic Era	2-6
2.2.3.1 Triassic System	2-6
2.2.3.2 Jurassic System	2-6
2.2.3.3 Cretaceous System.....	2-7
2.2.3.4 Lower Cretaceous	2-7
2.2.3.5 Upper Cretaceous	2-7
2.2.4 Cenozoic Era	2-8
2.2.4.1 Tertiary System	2-8
2.2.4.2 Quaternary System	2-9
2.3 Structural Geology and Tectonics.....	2-10
2.4 Geophysics and Geochemistry.....	2-13
2.5 Historical Geology	2-13
2.5.1 Cambrian through Mississippian Periods	2-13
2.5.2 Pennsylvanian-Permian Periods	2-13
2.5.3 Triassic-Jurassic Periods	2-14
2.5.4 Lower Cretaceous Period.....	2-14

CONTENTS (Cont'd)

2.5.5 Upper Cretaceous-Tertiary Periods	2-14
2.5.6 Quaternary Period	2-15
3.0 DESCRIPTION OF MINERAL RESOURCES	3-1
3.1 Leasable Minerals	3-2
3.1.1 Oil and Natural Gas	3-3
3.1.1.1 Origin, Occurrence, and Trapping of Oil and Natural Gas	3-3
3.1.1.2 Historical Development and Production	3-7
3.1.1.3 Origin and Occurrence of Coalbed Methane	3-30
3.1.1.4 CBM and Production in the Rawlins RMPPA	3-32
3.1.2 Coal.....	3-34
3.1.2.1 Hanna Coalfield.....	3-36
3.1.2.2 Great Divide Basin Coalfield	3-39
3.1.2.3 Rock Creek Coalfield	3-41
3.1.2.4 Kindt Basin Coalfield	3-41
3.1.2.5 Little Snake River Coalfield	3-42
3.1.2.6 Goshen Hole Coalfield	3-44
3.1.3 Oil Shale	3-44
3.1.4 Phosphate.....	3-45
3.1.5 Other Leasables	3-46
3.1.5.1 Sodium Sulfate	3-46
3.1.5.2 Potash	3-46
3.1.5.3 Geothermal Resources	3-47
3.2 Locatable Minerals	3-48
3.2.1 Sedimentary Uranium Deposits	3-56
3.2.1.1 Shirley Basin Deposits	3-56
3.2.1.2 Poison Buttes Deposits	3-57
3.2.1.3 Red Desert Deposits	3-57
3.2.1.4 Great Divide Basin Mineralization.....	3-57
3.2.1.5 Sedimentary Uranium Prospect Areas	3-58
3.2.2 Titaniferous Magnetite Deposits.....	3-58
3.2.2.1 Iron Mountain District	3-58
3.2.2.2 Sheep Mountain Black Sandstones.....	3-59
3.2.3 Stratabound Gold Deposits	3-59
3.2.3.1 Ferris Mountains.....	3-59
3.2.3.2 Seminoe Mountains	3-59

CONTENTS (Cont'd)

3.2.4	Copper-Gold Deposits	3-60
3.2.4.1	Jelm Mountain District.....	3-60
3.2.4.2	Cooper Hill District.....	3-60
3.2.4.3	Silver Crown District.....	3-61
3.2.5	Kimberlite Pipes and Diamonds	3-61
3.2.5.1	Stateline District	3-61
3.2.5.2	Iron Mountain District	3-61
3.2.6	Rare Earth Elements and Yttrium	3-61
3.2.6.1	Tie Siding Pegmatites	3-62
3.2.6.2	Red Mountain Syenite.....	3-62
3.2.6.3	Big Creek Pegmatite	3-62
3.2.6.4	Fox Creek Pegmatites	3-63
3.2.7	Alumina Deposits.....	3-63
3.3	Salable Minerals.....	3-63
3.3.1	Aggregates (Sand and Gravel)	3-64
3.3.1.1	Terrace Deposits – Sand and Gravel	3-64
3.3.1.2	Alluvial Deposits	3-65
3.3.1.3	Wind-Blown Deposits	3-66
3.3.1.4	Conglomeratic or Consolidated Gravels.....	3-67
3.3.1.5	Baked and Fused Shale (aka “Scoria”)	3-68
3.3.2	Silica Sand	3-68
3.3.3	Limestone and Dimension Stone	3-68
3.3.4	Vermiculite	3-70
3.3.5	Pumice and Scoria	3-70
3.3.6	Common Clay	3-70
3.3.7	Decorative Stone	3-71
3.3.8	Epsomite	3-72
3.3.9	Petrified Wood	3-73
4.0	MINERAL RESOURCES DEVELOPMENT POTENTIAL	4-1
4.1	Leasable Minerals	4-1
4.1.1	Hydrocarbon Plays	4-2
4.1.2	Hydrocarbon Resources.....	4-21
4.1.3	Hydrocarbon Occurrence Potential.....	4-29
4.1.4	Projections of Future Activity	4-32
4.1.4.1	Oil and Natural Gas Price Estimates	4-32

CONTENTS (Cont'd)

4.1.4.2 Leasing	4-34
4.1.4.3 Seismic Surveys.....	4-38
4.1.4.4 Projections of Future Drilling Activity	4-38
4.1.5 Coal.....	4-49
4.1.5.1 Development Potential Coal	4-52
4.1.5.2 Unlikely Development Potential Coal.....	4-54
4.1.6 Oil Shale	4-55
4.1.7 Phosphate.....	4-55
4.1.8 Other Leasable Minerals	4-56
4.1.8.1 Sodium	4-56
4.1.8.2 Geothermal.....	4-56
4.2 Locatable Minerals	4-57
4.3 Salable Minerals.....	4-58
4.3.1 Aggregates (Sand and Gravel)	4-59
4.3.1.1 Oil and Gas Industry Requirements.....	4-62
4.3.1.2 Oil and Gas Industry	4-62
4.3.1.3 State/County/Municipality Requirements.....	4-65
4.3.1.4 Other Demand.....	4-65
4.3.2 Silica Sand.....	4-66
4.3.3 Limestone and Dimension Stone	4-67
4.3.4 Vermiculite	4-67
4.3.5 Pumice and Scoria	4-68
4.3.6 Common Clay.....	4-68
4.3.7 Decorative Rock and/or Stone	4-69
4.3.8 Epsomite.....	4-71
4.3.9 Petrified Wood	4-71
4.4 Mineral Potential Summary.....	4-72
5.0 RECOMMENDATIONS	5-1
6.0 REFERENCES.....	6-1

APPENDIX A – OIL AND GAS OPERATIONS

LIST OF TABLES

3-1	Oil and Gas Fields and Cumulative Production in the Rawlins RMPPA.....	3-8
3-2	Rawlins RMPPA Well Status on April 1, 2002.....	3-15
3-3	Summary of Data for All Deep Wells (>15,000 Feet) Drilled in Rawlins RMPPA.....	3-24
3-4	Secondary and Tertiary Recovery Units in the RMPPA.....	3-27
3-5	Rawlins RMPPA CBM Methane Unit Agreements	3-34
3-6	Locatable Minerals Deposits in the Rawlins RMPPA.....	3-50
3-7	Locatable and Salable Minerals Deposit Location Index	3-53
3-8	Locations of Decorative Stone	3-71
4-1	USGS Conventional Play Data for Southwestern Wyoming Province (037)	4-6
4-2	USGS Conventional Play Data for the Denver-Cheyenne Basin Province (039).....	4-11
4-3	USGS Unconventional Play Data for Southwestern Wyoming Province (037)	4-20
4-4	USGS Unconventional Play Data for Denver-Cheyenne Basin Province (037)	4-24
4-5	USGS Conventional Play Resources for Southwestern Wyoming Province (037)	4-25
4-6	USGS Conventional Play Resources for Denver-Cheyenne Basin Province (039)	4-26
4-7	USGS Unconventional Play Resources for Southwestern Wyoming Province (037)	4-27
4-8	USGS Unconventional Play Resources for Denver-Cheyenne Basin Province (039)	4-28
4-9	Distribution of Federal Acreage Covered by Active Federal Oil and Gas Leases in the Rawlins RMPPA.....	4-35
4-10	Oil and Gas Development Potential Classifications Determined for the Rawlins RMPPA.....	4-42
4-11	Coalbed Gas Development Potential Classifications Determined for the Rawlins RMPPA.....	4-46
4-12	Estimates of Coalbed Gas Resources in the Rawlins RMPPA.....	4-49
4-13	Anticipated Drilling Related Disturbance, in Acres, for Rawlins RMPPA.....	4-50
4-14	Projections of Short-term (2010) and Long-term (2020) Drilling Activity with Associated Surface Disturbance.....	4-51
4-15	Wyoming Coal Production – 2000	4-51
4-16	Summary of Coal Development Potential Rawlins RMPPA.....	4-53
4-17	Designated Community Pits (Sand and Gravel).....	4-60
4-18	Designated Common Use Pits (Sand and/or Gravel)	4-61
4-19	Designated Free-Use Pits (Sand and/or Gravel).....	4-61
4-20	Authorized Negotiated Sale Pits (Various Commodities).....	4-61
4-21	Estimated Gravel Requirements for State/County/Municipal Roads	4-66

LIST OF FIGURES

1-1	General Location Map of the RMPPA.....	1-3
2-1	Physiographic Provinces in Relation to the Wyoming Basin.....	2-2
2-2	Stratigraphic Nomenclature Chart.....	2-4
2-3	Major Structural Elements of the Rawlins RMPPA.....	2-11
2-4	Diagrammatic Cross-section of Southeastern Wyoming.....	2-12
3-1	Trap Types	3-5
3-2	Number of New Wells Drilled, by Year, in the RMPPA	3-13
3-3	Well Depth Distribution for Wells Drilled Since 1990 in the RMPPA.....	3-14
3-4	Wells Drilled and Wells Abandoned in the RMPPA from 1980 to 2001	3-14
3-5	Wells Drilled for Oil and Gas	3-16
3-6	Yearly Total Gas Production and Production from Federal, Private, and State Lands in the Rawlins RMPPA.....	3-17
3-7	Yearly Total Oil Production and Production from Federal, Private, and State Lands in the Rawlins RMPPA.....	3-19
3-8	Total Producing Wells and Federal, Private, and State Producing Wells in the Rawlins RMPPA, by Year	3-20
3-9	Deep Wells (>15,000 feet) and Deep Reservoir Potential	3-22
3-10	Non-CBM Federal Unit Agreements	3-29
3-11	CBM Unit Agreements	3-31
3-12	Typical CBM Well Production Profile	3-33
3-13	Wyoming Coalfields.....	3-35
3-14	Potential Mineral Resources	3-49
3-15	Locatable Minerals	3-52
3-16	Salable Minerals	3-69
4-1	Location of USGS Conventional Southwestern Wyoming Province Rock Springs Uplift, Cherokee Arch, and Subthrust Plays.....	4-3
4-2	Location of USGS Conventional Southwestern Wyoming Province Basin Margin and Platform Plays	4-4
4-3	Location of USGS Conventional Southwestern Wyoming Province Deep Basin Structure Play	4-5
4-4	Location of USGS Conventional Denver-Cheyenne Basin Province Pierre Shale Sandstone Play	4-7
4-5	Location of USGS Conventional Denver-Cheyenne Basin Province Dakota Group Play....	4-8
4-6	Location of USGS Conventional Denver-Cheyenne Basin Province Basin Margin Structural Play	4-9
4-7	Location of USGS Conventional Denver-Cheyenne Basin Province Permian-	

LIST OF FIGURES (Cont'd)

Pennsylvanian and Subthrust Structural Plays.....	4-10
4-8 Location of USGS Unconventional Southwestern Wyoming Province Cloverly-Frontier Basin-centered Gas Play	4-12
4-9 Location of USGS Unconventional Southwestern Wyoming Province Mesaverde Basin-centered Gas Play.....	4-13
4-10 Location of USGS Unconventional Southwestern Wyoming Province Lewis Basin-centered Gas Play.....	4-14
4-11 Location of USGS Unconventional Southwestern Wyoming Province Fox Hills-Lance Basin-centered Gas Play	4-15
4-12 Location of USGS Unconventional Southwestern Wyoming Province Fort Union Basin-centered Gas Play.....	4-16
4-13 Location of USGS Unconventional Southwestern Wyoming Province Isles and Lance Coalbed Gas Plays.....	4-17
4-14 Location of USGS Unconventional Southwestern Wyoming Province Almond Coalbed Gas Plays	4-18
4-15 Location of USGS Unconventional Southwestern Wyoming Province Fort Union CBM Play.....	4-19
4-16 Location of USGS Continuous-type Denver-Cheyenne Basin Province J Sandstone Deep Gas Play	4-22
4-17 Location of USGS Denver-Cheyenne Basin Province Fractured Niobrara-type Plays	4-23
4-18 Undiscovered Technically Recoverable Natural Gas Resources	4-30
4-19 Oil and Gas Occurrence Potential	4-31
4-20 Historical Spot Gas Prices for Northwest Pipeline at Opal, Wyoming, with Projections to 2020.....	4-33
4-21 Plot of Historical Wyoming Crude Oil Prices, with Projections to 2020.....	4-33
4-22 Location of Federal Oil and Gas Leases	4-36
4-23 Summary of Federal Oil and Gas Lease Sale Results, by Year, for the 1996-2001 Period, Rawlins RMPPA	4-37
4-24 Summary of the Total Amount of Bonus Money Received from Federal Oil and Gas Leasing and the Average Bid by Year, for the 1996-2001 Period, Rawlins RMPPA.....	4-37
4-25 Approved Seismic Notices of Intent to Conduct Geophysical operations (NOIs), by Year, on BLM Managed Surface in the Rawlins RMPPA.....	4-39
4-26 Non-coalbed Methane Development Potential Areas	4-41
4-27 Rawlins RMPPA, Coalbed Gas Wells and Their Status.....	4-44
4-28 Coalbed Methane Development Potential Areas	4-45
4-29 Coalbed Gas Production as a Percent of Total Natural Gas Produced in Wyoming.....	4-48